

INFANT SIMULATOR

FIELD OF THE INVENTION

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This invention broadly relates to the field of simulated child care. More specifically, the invention relates to infant simulators used in educational programs for educating prospective parents about the realities of parenthood, assisting in the education and training of personnel entering the child-care profession, and assisting in the
10 continuing education of persons working in the child-care profession.

BACKGROUND

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Teen-age pregnancy is an ever increasing problem. Teen-age parents, surveyed as to why they elected to have a baby, gave such reasons as "babies are so cute," "I wanted attention," and "I needed someone to love and love me back." Such romantic feelings toward having a baby almost never include an understanding of the responsibilities imposed by a baby, including loss of sleep, loss of freedom, the need for
20 constant attention, etc. Attempts to educate teen-agers about the trials and tribulations of caring for an infant and raising a child, using the traditional educational methods of lecture and readings, are rarely successful.

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Some resourceful educators, realizing that traditional educational methods are inadequate, have attempted to demonstrate the care requirements of an infant by requiring students to carry a sack of flour, an egg or a plant for several days. While somewhat exemplary of the care requirements of an infant, such programs do not fairly represent the care requirements of an actual infant and have proven to be of limited
30 success.

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United States Patents Nos. 3,190,038 issued to Kardon, 3,490,170 issued to Wolf, 3,514,899 issued to Bonanno et al., 4,115,948 issued to Burks and 5,094,644 issued to Kelley describe dolls that will wet a diaper after being fed from a bottle. The dolls described in Kardon and Wolf each include electrical circuitry capable of initiating crying when a diaper on the doll is sufficiently wetted after being fed from a bottle, and terminating such crying upon removal of the wetted diaper. Similarly, the doll described in Bonanno et al. further includes electrical circuitry capable of initiating crying when the doll is diapered and a bottle is removed from the mouth of the doll, and terminating such crying by removing the diaper from the doll. Such dolls are not useful for educating students about the trials and tribulations of caring for an infant as the feeding and wetting cycle, with or without crying, is under control of the user. The student, unless under constant supervision by an educator, can feed and change the doll on a schedule selected by the student. In addition, the dolls do not accurately simulate the care requirements of an actual infant in that the student is not instructed by the doll to replace the wetted diaper with a dry diaper to terminate crying.

United States Patents No. 4,249,338 issued to Wexler discloses a doll which emits a crying sound when a manually operated switch is actuated. The user must then determine which of several switches, labeled with such actions as feeding, diaper changing or back patting, will turn off the crying sound. While interesting as a plaything, this doll suffers from the same drawback as the "feed and wet" dolls in that activation of crying is under control of the user. The student, unless under constant supervision by an educator, can activate crying on a schedule selected by the student.

United States Patents No. 4,451,911 issued to Klose et al. discloses a doll which can operate in two different modes. In a first mode, the doll emits different sounds based upon which of several switches, located at various positions on the body of the doll, is actuated (e.g., actuation of the mouth switch produced "yum-yum," while actuation of the back switch produces "aahh"). In a second mode the doll emits a sound and the user must then determine which of the switches will turn off the crying sound and

with any combination of the described features, including the ability the selectively activate and deactivate individual features for each assignment period. The infant simulator is equipped to record the quality of care and responsiveness of a person caring for the infant simulator and/or signal the person caring for the infant simulator when care is required.

The features can be conveniently grouped into the categories of (i) environmental condition sensors, (ii) episodic events, and (iii) ancillary features.

ENVIRONMENTAL CONDITIONS

Temperature Sensor

Infants should not be exposed to temperature extremes. The infant simulator can be equipped with a temperature sensor capable of sensing the environmental temperatures to which the infant simulator is exposed.

In a first embodiment, the infant simulator is further equipped with a system for recording the sensed temperature. In a second embodiment, the infant simulator is further equipped with a system for generating a perceptible thermal exposure signal when the sensed temperature falls above or below a defined acceptable temperature range. A preferred embodiment combines both the recording and signaling systems so that the person caring for the infant simulator is advised when the environmental temperature has reached an unacceptable level and the recorded information can be reviewed by a teacher or administrator upon completion of the assignment.

Compression Sensor

Infants must be handled with care at all times and should never be squeezed. One of the more prevalent abuses results when a frustrated care provider
5 squeezes the infant, usually the infants arm, leg or head. The infant simulator can be equipped with a compression sensor capable of sensing compression of the infant simulator.

In a first embodiment, the infant simulator is further equipped with a
10 system for recording the sensed compression. In a second embodiment, the infant simulator is further equipped with a system for generating a perceptible distress signal when compression is sensed. A preferred embodiment combines both the recording and signaling systems so that the person caring for the infant simulator is immediately notified that they have injured the infant simulator and the recorded information can be
15 reviewed by a teacher or administrator upon completion of the assignment.

EPISODIC EVENTS

20 *Diaper Change*

Infants require periodic diaper changes. A realistic simulation of a diaper change should include the actual changing of a diaper. By requiring the “soiled” diaper to be removed and a new diaper placed upon the infant simulator, the person caring for
25 the infant simulator learns that you must carry an extra diaper at all times, and gains a more complete understanding of the requirements of an actual diaper change (*e.g.*, a person carrying the infant simulator into a restaurant would, assuming some level of modesty and etiquette, take the infant simulator to the rest room to change the diaper).

Feeding with Burp

Infants must be regularly fed. A realistic simulation of a feeding should require both feeding and burping of the infant simulator. In order to accurately emulate a feeding, the infant simulator can be equipped with both a feeding-request module and a burping-request module, with the burping-request module requiring actual patting of the infant simulator.

The feeding module can include (i) a system for generating a perceptible feeding-request signal, (ii) a system in communication with the feeding-request signal generating system for arresting the feeding-request signal in response to receipt of a feeding signal, (iii) a device for transmitting the feeding signal to the feeding-request signal arresting system when placed in communicative proximity to the infant simulator and thereby arresting the feeding-request signal.

The burping-request module can include (i) a system for generating a perceptible burping-request signal, (ii) a system for initiating generation of the burping-request signal in communication with both the feeding-request module and the burping-request signal generating system for initiating generation of the burping-request signal after the feeding signal is received by the feeding-request module, and (iii) a system in communication with the burping-request signal generating system for detecting patting of the doll and arresting the burping-request signal when patting is detected.

The infant simulator can further be equipped with a means for individually or separately measuring and recording the duration of each feeding-request episode and each burping-request episode (*i.e.*, the time period between initiation of the perceptible feeding-request signal and the commencement of feeding for a feeding-request episode, and the time period between initiation of the perceptible burping-request signal and the commencement of patting for a burping-request episode.)

Fussy and Demand Event

Infants will occasionally fuss for one reason or another and, despite every effort by the parent or other care-provider, cannot be comforted. In such situations, the infant tends to continue fussing until the unknown cause of the fussing dissipates of its own accord. In order to accurately emulate the frustration encountered by parents and other care-providers in such situations, the infant simulator can be equipped with a demand module (*e.g.*, a diaper-change module, a rocking module, a feeding module, etc.) and a fussing module, wherein only the demand module is capable of being satisfied.

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The demand module can include (i) a system for generating a perceptible demand signal, (ii) a system in communication with the demand signal generating system for arresting the demand signal in response to receipt of a satisfaction signal, and (iii) a device for transmitting the satisfaction signal to the demand signal arresting system when placed in communicative proximity to the infant simulator and thereby arresting the demand signal.

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The fussing module can include (i) a system for generating a perceptible fussing signal, (ii) a fussing interval timer in communication with the fussing signal generating system for initiating generation of the fussing signal at intervals; and (iii) a fussing duration timer in communication with the fussing signal generating system for terminating generation of the fussing signal at the end of a fussing period.

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Since the fussing module does not include a system capable of arresting the fussing signal, the fussing signal will necessarily continue until the end of the fussing period regardless of the actions of the parent or other care-provider.

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ANCILLARY FEATURES

The features described below are labeled as ancillary features because they function to enhance performance of an infant simulator exhibiting at least one type of a demand event. For practical purposes, the disclosed ancillary features are operable in combination with any of the demand modules disclosed herein (*i.e.*, diaper-change, rocking, feeding with burp, and fussing with demand event) as well as any other demand module requiring the parent or other care-provider to provide the infant simulator with a satisfaction signal.

As utilized herein, including the claims the phrase “*demand module*” references a module which includes at least (i) a means for generating a perceptible demand signal, and (ii) a means in communication with the demand signal generating means for arresting the demand signal in response to receipt of a satisfaction signal. As a general matter, a “demand module” signals a care-provider that some type of interaction is required between the care-provider and the infant, and arrests the signal when the required interaction is provided.

Contented Signal Feature

The responsibility of caring for an infant can engender the contrasting emotions of fulfillment and frustration. A realistic simulation of caring for an infant should include events emulating both the positive and negative aspects of caring for an infant.

The infant simulator can be equipped with a contented condition module which, in combination with a demand module, for providing positive feedback to the person caring for the infant simulator when proper care is provided. The contented module can include (i) a system for generating a perceptible contented signal, and (ii) a system in communication with the demand module and the perceptible contented signal

least, (i) a system for receiving an identification signal personal to the assigned care-provider, and (ii) a system in communication with the identification-signal receiving system and the demand module effective for preventing arresting of the demand signal until the identification signal is received by the identification-signal receiving system.

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Multiple Behavior Modes Feature

Infants have different care requirements. Some infants will sleep for several hours at night, while others will wake almost every hour and require some type of attention. In order to emulate the different care requirements of different infants, the infant simulator can be equipped to permit a teacher or administrator to select between several programs which require different levels of care. These different levels of care can be produced by altering the time interval between events (*i.e.*, increase or decrease the number of events occurring within an assignment period) and/or altering the duration of each event (*i.e.*, increase or decrease the length of each period). The different levels of care can be set to represent the care requirements of an easy, an average and a difficult infant, thereby allowing the teacher or administrator to tailor the simulation to each specific student.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of one embodiment of the infant simulator including one embodiment of an identification key and tamper indicating bracelet.

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Figures 2a-2j are a flowchart of one embodiment of the infant simulator.

Figure 3 is a cross-sectional side view of the infant simulator shown in Figure 1, showing one embodiment of the internal electrical components of the infant simulator.

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ordinary handling, hugging, lying on a carpeted floor, rubbing of the stomach, light tickling, etc.

As utilized herein, including the claims, the phrase “*compression episode*,” means the time period beginning when compression is sensed and ending when compression is no longer sensed.

As utilized herein, including the claims, the term “*continuous*,” when used in connection with the demand event of *feeding the doll*, means that the feeding signal transmitting means (*e.g.*, a bottle) is held in communicative position relative to the doll by a care provider so as to transmit the feeding signal to the feeding-request system (*e.g.*, the bottle is inserted into the mouth of the doll) without release of the feeding signal transmitting means by the care provider for any appreciable time period (*i.e.*, from a fraction of a second up to as long as about five seconds).

As utilized herein, including the claims, the term “*continuous*,” when used in connection with the demand event of *rocking the doll*, means that the doll is subjected to appropriate levels of accelerative motion without stop or separated only by stationary periods of modest duration (*i.e.*, from a fraction of a second up to as long as about five seconds).

As utilized herein, including the claims, the term “*continuous*,” when used in connection with the *recording of temperature values*, means that the temperature is recorded on a predetermine schedule (*e.g.*, every nanosecond, every second, every ten seconds, every two minutes, etc.) without interruption.

As utilized herein, including the claims, the phrase “*demand episode*,” refers to an event requiring a specified interaction between the doll and a care-provider in response to a signal from the doll that such an interaction is desired. Each demand episode, from the perspective of a care provider, begins when a perceptible demand signal

is initiated by the doll and ends when an appropriate satisfaction signal or action is transmitted to the doll in response to the demand signal. Exemplary, demand episodes include specifically, but not exclusively, diaper-change episodes, feeding-request episodes, burping-request episodes and rocking-request episodes.

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As utilized herein, including the claims the phrase "**demand module**" references a module which includes at least (i) a means for generating a perceptible demand signal, and (ii) a means in communication with the demand signal generating means for arresting the demand signal in response to receipt of a satisfaction signal. As a general matter, a "demand module" signals a care-provider that some type of interaction is required between the care-provider and the infant, and arrests the signal when the required interaction is provided.

As utilized herein, including the claims, the phrase "**demand period**," means the period of time during which the demand signal will be generated and expressed by the doll unless a satisfaction signal or action is being received by the doll. Exemplary, demand periods include specifically, but not exclusively, diaper-change periods, feeding-periods, burping periods and rocking periods.

As utilized herein, including the claims, the phrase "**diaper-change episode**," refers to the event of changing the doll's diaper in response to a signal from the doll that the diaper is soiled. Each diaper-change episode, from the perspective of a care provider, begins when a perceptible soiled-diaper signal is initiated and ends when a changed-diaper signal is transmitted. It is noted for purposes of clarity that this definition is not intended to mandate the specific signal received by the diaper-change module for initiating or terminating the timing of a diaper-change episode (*e.g.*, timing of a diaper-change episode can be initiated by a signal emanating from the diaper-change interval timer or a signal generated by the perceptible soiled-diaper signal generating means), nor specify the particular sequence by which an electrical signal must travel through the diaper-change module (*e.g.*, the diaper-change module may be configured and arranged

As utilized herein, including the claims, the phrase “*feeding-request episode*,” refers to the event of feeding the doll in reaction to a demand signal from the doll indicating a desire to be fed. Each feeding-request episode, from the perspective of a care provider, begins when a perceptible feeding-request signal is initiated and ends when feeding is commenced. It is noted for purposes of clarity that this definition is not intended to mandate the specific signal received by the feeding-request module for initiating or arresting the timing of a feeding-request episode (*e.g.*, timing of a feeding-request episode can be initiated by a signal emanating from the feeding-request interval timer or a signal generated by the perceptible feeding-request signal generating means), nor specify the particular sequence by which an electrical signal must travel through the feeding-request module (*e.g.*, the feeding-request module may be configured and arranged so that the feeding-request duration timer receives a signal to start timing a feeding-request episode before, after or simultaneously with the receipt of a corresponding signal by the perceptible feeding-request signal generating means).

As utilized herein, including the claims, the term “*infant*” refers to a young human being ranging in age from a newborn, including a premature newborn, to an approximately one year old child.

As utilized herein, including the claims, the term “*key*” refers to any device configured and arranged to fit within and communicate with a complementary keyhole, including specifically, but not exclusively a passkey of specified configuration, a card having holes in a specified pattern, a card bearing information on a magnetic strip, a magnet of specified strength and configuration, etc.

As utilized herein, including the claims, the phrase “*predetermined value*” means a specific value (*e.g.*, 10 minutes) and includes both permanently assigned values (*e.g.*, a duration period which is always 10 minutes) and values assigned for an assignment period and capable of being reassigned for subsequent assignment periods

nor specify the particular sequence by which an electrical signal must travel through the rocking-request module (e.g., the rocking-request module may be configured and arranged so that the rocking-request duration timer receives a signal to start timing a rocking-request episode before, after or simultaneously with the receipt of a
5 corresponding signal by the perceptible rocking-request signal generating means).

As utilized herein, including the claims, the phrases “*adjusting the potential duration of a period*,” and “*adjusting the potential duration of a time interval*” means changing the probability of occurrence such that a longer or shorter
10 duration is more likely to occur. Such adjustment can occur by (i) changing one or both of the endpoints of the time range from which the duration of the period or interval can be selected (e.g., a change from a 10 to 20 minute time range to a 10 to 50 minute time range or a change from a 10 to 20 minute time range to a 40 to 50 minute time range), and/or (ii) changing the statistical preference for a time value within a defined time range (e.g., a
15 change from a 10 to 20 minute time range with a 40% chance of selecting a duration of 15 to 20 minutes to a 10 to 20 minute time range with an 80% chance of selecting a duration of 15 to 20 minutes).

As utilized herein, including the claims, the phrase “*perceptible signal*”
20 means any and all means of communication capable of conveying notice or warning to a care provider, including specifically, but not exclusively audible signals (e.g., crying), olfactory signals (e.g., emission of odorous gas), tactile signals (e.g., wet diaper), visual signals (e.g., gesture), and multimedia signals (e.g., crying and tears).

As utilized herein, including the claims, the phrase “*substantially identical signals*,” refers to signals perceived by the same sense (e.g., audible signals) and of the same general type (e.g., crying sound, shaking body, floral smell, etc.) with some aspect of the signals perceptibly different (e.g., different pitch, different rate, different intervals between repetitions, different volumes, etc.).
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As utilized herein, including the claims, the phrase “*thermal exposure episode*,” means the time period beginning when a sensed temperature falls outside a defined acceptable temperature range and ending when a subsequently sensed temperature falls within the defined acceptable temperature range.

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Nomenclature

	05	Infant Simulator	
10	10	Doll	
	11	Head	
	12	Torso	
	13	Arms	
	14	Legs	
15	16	Back of Doll	
	20	Central Microcontroller Unit	
	21	Tamper Indicating Label	
	30	Position Sensor	
	40	Temperature Sensor	
20	50	Compression Sensing System	
	51	Electrical Circuit	
	51a	First Contact	
	51b	Second Contact	
	60	Diaper	
25	60a	First Diaper	
	60b	Second Diaper	
	61	Magnet Attached to Diaper	
	62	Diaper-Change Switches	
	62a	First Diaper-Change Switch	
30	62b	Second Diaper-Change Switch	
	70	Motion Sensor (Rocking, Burping and Abuse)	
	80	Bottle	
	80n	Nipple of Bottle	
	81	Magnet Attached to Bottle	
35	82	Feed Switch	
	90	Identification Key	
	91	Tamper Indication Bracelet	
	40	100	Initiation Module
110		Position Sensing Module	
120		Temperature Sensing Module	
130		Compression Sensing Module	

	140	Diaper-Change Module
	150	Rocking Module
	160	Feeding Module
	170	Burping Module
5	180	Fussy Module
	190	Assignment Period Module
	210	Demand Signal Generating Feature
	220	Recording Feature
	230	Contented Signal Feature
10	240	Escalating Demand Signal Feature
	250	Identification System Feature
	260	Multiple Time Interval Duration Feature
	270	Multiple Period Duration Feature
	S ₁	Repositioning-Request Signal Generated by the Infant Simulator
15	S ₂	Thermal Exposure Signal Generated by the Infant Simulator
	S ₃	Distress Signal Generated by the Infant Simulator
	S ₄	Soiled-Diaper Signal Generated by the Infant Simulator
	St ₄	Diaper-Change Satisfaction Signal Provided by Care Provider
	St ₄ ⁺	First Diaper-Change Satisfaction Signal
20	St ₄ ⁻	Second Diaper-Change Satisfaction Signal
	S ₅	Rocking-Request Signal Generated by the Infant Simulator
	St ₅	Rocking-Request Satisfaction Signal Provided by Care Provider
	S ₆	Feeding-Request Signal Generated by the Infant Simulator
	St ₆	Feeding-Request Satisfaction Signal Provided by Care Provider
25	S ₇	Burping-Request Signal Generated by the Infant Simulator
	St ₇	Burping-Request Satisfaction Signal Provided by Care Provider
	S ₈	Fussy Signal Generated by the Infant Simulator
	+	Positive ("Contented") Signal Generated by Infant Simulator
30	S ^{ID}	Identification Signal
	Sw ^{ID}	Identification Switch
	↪	Bypass

35 Construction

As shown in Figure 1, the infant simulator 05 comprises a doll 10 having a recess (unnumbered) within the back 16 of the doll 10 capable of retaining a central microcontroller unit 20 and a battery pack 25 for powering the central microcontroller unit 20.

A lock-and-key system (not shown) or tamper indicating device, such as a tamper indicating label **21**, can be provided for purposes of signaling and/or recording efforts to remove or otherwise access the central microcontroller unit **20** and/or battery pack **25** from the doll **10**.

The doll **10** preferably has the appearance of a young infant (*e.g.*, approximately 40 to 80 cm in length and approximately 3 to 5 kg in weight) with a head **11**, torso **12**, arms **13**, and legs **14**. The doll **10** can be sculpted to depict the skin color and facial feature of various ethnic groups including specifically, but not exclusively, African American, Asian, Caucasian, Hispanic, and Native American.

The infant simulator **05** can include a variety of modules designed to emulate the care requirements of an infant. These modules include (i) a position sensing module **110**, (ii) a temperature sensing module **120**, (iii) a compression sensing module **130**, (iv) a diaper-change module **140**, (v) a rocking module **150**, (vi) a feeding module **160** with or without an associated burping module **170**, and (vii) a fussy module **180**. The infant simulator **05** can be designed and programmed with any combination of the described modules, including the ability to selectively activate and deactivate individual modules for each assignment period.

The infant simulator **05** is equipped to record the quality of care and responsiveness of a person caring for the infant simulator **05** and/or signal the person caring for the infant simulator **05** when care is required.

The modules can be conveniently grouped into the categories of (i) environmental condition sensors, and (ii) episodic events. In addition, the specifics of each episodic event can be adjusted by the use of one or more ancillary features which can be programmed into the central microcontroller unit **20**.

ENVIRONMENTAL CONDITIONS

The environmental conditions of abuse, position, temperature and/or
5 compression can be sensed and reported.

Abuse Sensing System

The infant simulator **05** can be equipped with a motion sensor **70** capable
10 of detecting physical abuse of the doll **10** such as by shaking, striking or throwing of the
infant simulator **05**. Such an abuse sensing system is described in United States Patent
No. 5,443,388 issued to Jurmain et al.

A number of different types and styles of motion sensors **70** may be
15 effectively used to sense and report abuse. One such sensor, capable of providing
variable output dependent upon the force of the motion to which the infant simulator **05** is
subjected, is a magnetic field induced shock sensor manufactured by Directed
Electronics, Inc. under Part No. 504IC wherein movement of a magnet, resulting from a
corresponding movement of the doll **10**, generates an electrical current in an induction
20 coil, with the strength of the electrical current proportional to the speed and distance
traveled by the magnet. The motion sensor **70** is electrically connected to the central
microcontroller unit **20** wherein the strength of the electrical current generated by the
motion sensor **70** can be checked against predefined threshold limitations for producing
different signals dependent upon the strength of the electrical current. This permits the
25 single motion sensor **70** to differentiate between a modest force, such as produced by
normal handling, rocking and burping of the infant simulator **05**, and excessive force,
such as experienced when the infant simulator **05** is thrown, shaken or otherwise abused.
When motion of the appropriate amplitude is sensed, an electrical ^{abuse} ~~satisfaction~~ signal is
sent to the central microcontroller unit **20** and an abuse event reported.

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OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records and reports only fact that the infant simulator was unacceptably positioned at least once during the assignment period.	YES/NO	Light ON/OFF
2	Records and reports the number of times the infant simulator was unacceptably positioned.	Number	"5."
1	Records and reports total amount of time the infant simulator was unacceptably positioned during an assignment period.	Minutes	45
3	Records and reports the number of times the infant simulator was unacceptably positioned and the total amount of time the infant simulator was unacceptably positioned.	#/Minutes	5:45

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
3	Records and reports the number of times the infant simulator was unacceptably positioned, the total amount of time the infant simulator was unacceptably positioned, and the mean duration of each occurrence.	#/Minutes Minutes	5:45 03
3	Records and reports the amount of time the infant simulator remained in an unacceptable position for each occurrence during an assignment period.	#/Minutes	1: 03 2: 18 3: 20 4: 02 5: 02
4	Records and reports the number of times the infant simulator was unacceptably positioned, the total amount of time the infant simulator was unacceptably positioned, and the amount of time the infant simulator remained in an unacceptable position for each occurrence during an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

In a second embodiment, the central microcontroller unit **20** is connected to a system (not shown) capable of generating a repositioning-request signal S_1 , such as an audible cry or scream. The central microcontroller unit **20** is programmed to generate the repositioning-request signal S_1 whenever the infant simulator **05** is placed in an unacceptable position (e.g., laying face down or upside down) and left in that position

beyond a minimum threshold time period (*e.g.*, ten seconds). Generation of the repositioning-request signal S_1 warns the person caring for the infant simulator 05 that the infant simulator 05 is in an improper position and corrective action is required. The repositioning-request signal S_1 and timing of the positioning-request episode can be
5 terminated by simply repositioning the infant simulator 05 into an acceptable position, thereby opening the position sensor 30 and terminating transmission of an electrical signal from the position sensor 30 to the central microcontroller unit 20.

The central microcontroller unit 20 can be programmed to generate the
10 repositioning-request signal S_1 only at the beginning of each occurrence of improper positioning (*i.e.*, generate a three second signal once the infant simulator 05 is sensed in an unacceptable position for longer than the minimum threshold time period), periodically throughout an improper positioning occurrence, or continuously throughout an improper positioning occurrence.

15 A preferred embodiment of the position sensing system 30 combines both the recording and signaling systems.

The repositioning-request signal S_1 may be intensified, in accordance with
20 the ancillary feature of providing an escalated demand signal 240, based upon an increase in the length of time the infant simulator 05 is unacceptably positioned. An example of each is set forth in Table Two, provided below.

TABLE TWO

(ESCALATING REPOSITIONING-REQUEST SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	LENGTH OF TIME INFANT SIMULATOR REMAINS IN AN UNACCEPTABLE POSITION (MINUTES)
1 st Intensity (soft cry)	< 10
2 nd Intensity (loud cry)	> 10

Temperature Sensing System 40

The infant simulator 05 can be equipped with a temperature sensor 40, such as a simple thermocouple, capable of sensing the environmental temperatures to which the infant simulator 05 is exposed and communicating the sensed temperatures to the central microcontroller unit 20.

In a first embodiment, a recording function within the central microcontroller unit 20 records the sensed temperatures for later review by the teacher or program administrator. The specific information recorded and reported by the central microcontroller unit 20 can range from the relatively simple to the complex. For example, the central microcontroller unit 20 can be programmed to simply record and report whether the sensed environmental temperature fell outside a defined acceptable temperature range (e.g., 10°C and 40°C, preferably 15°C and 35 °C) at least once during the assignment period. Alternatively, the central microcontroller unit 20 can record temperature values every two minutes throughout an entire assignment period and

graphically report the recorded temperatures at the end of the assignment period. A nonexhaustive list of options for recording and reporting thermal exposure data is set forth in Table Three, provided below.

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TABLE THREE
(*OPTIONS FOR RECORDING AND REPORTING
THERMAL EXPOSURE DATA*)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records only fact that sensed temperature fell outside of acceptable temperature range at least once (i.e. thermal exposure episode occurred).	YES/NO	Light ON/OFF
2	Records number of thermal exposure episodes.	Number	"3."
3	Records high and low temperature extremes.	°C	22°C: 49°C.
4	Records high and low temperature extremes experienced during all thermal exposure episodes.	°C	*°C: 49 °C.
5	Records the number and temperature extreme for each thermal exposure episode.	°C	1: 42°C 2: 44°C 3: 53°C 4: 8° C

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OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
6	Records the number and duration of each thermal exposure episode.	# / Minutes	1: 06 2: 18 3: 02 4: 02 5: 02
7	Records the number of thermal exposure episodes and continuously records the temperature throughout a thermal exposure episode.	# /°C	1: 07, 07, 06, 07, 08, 06, 04, 03, 05, 07. 2: 41, 43, 45, 46, 47, 47, 47, 47, 45, 42, 41.
8	Continuously records the temperature throughout an assignment period.	Minutes/°C	02: 27 04: 27 06: 28 08: 29 10: 28

In a second embodiment, the central microcontroller unit **20** is programmed with defined upper and lower temperature limits (*e.g.*, 10°C and 40°C, preferably 15°C and 35 °C) and connected to a system (not shown) capable of generating a perceptible thermal exposure signal S_2 . The central microcontroller unit **20** is programmed to generate the perceptible thermal exposure signal S_2 when the sensed temperature falls outside the acceptable temperature range. Generation of the perceptible

thermal exposure signal S_2 warns the person caring for the infant simulator 05 that the environmental temperature has reached an unacceptable level and corrective action is required. The thermal exposure signal S_2 and timing of the thermal exposure episode can be terminated by removing the infant simulator 05 from the unacceptably warm or cold environment (e.g., removing the infant simulator 05 from the car), thereby returning the body temperature of the infant simulator 05 to an acceptable temperature and ceasing transmission of an electrical signal from the temperature sensor 40 to the central microcontroller unit 20.

10 A preferred embodiment of the temperature sensor module combines both the recording and signaling systems.

15 The central microcontroller unit 20 can be programmed to generate the perceptible thermal exposure signal S_2 only at the beginning of a thermal exposure episode (*i.e.*, generate a ten second signal as soon as a sensed temperature falls outside the acceptable temperature range), periodically throughout a thermal exposure episode (*e.g.*, generate a two second signal every minute once the sensed temperature falls outside the acceptable temperature range until the sensed temperature returns to the acceptable temperature range), or continuously throughout a thermal exposure episode.

20 The thermal exposure signal S_2 may be intensified, in accordance with the ancillary feature of providing an escalated demand signal 240, based upon (i) an increase in the difference between the sensed temperature and the temperature limit, and/or (ii) an increase in the duration of the thermal exposure episode. An example of each is set forth
25 in Table Four, provided below.

TABLE FOUR

(ESCALATING THERMAL-DISCOMFORT SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	THERMAL EXPOSURE DURATION (MINUTES)	TEMPERATURE BEYOND ACCEPTABLE LIMIT (°C)
1 st Intensity (whimper)	< 5	< 5
2 nd Intensity (scream)	5 to 10	5 to 10
3 rd Intensity (shriek)	>10	>10

5

The temperature sensor 40, as with the central microcontroller unit 20 and battery pack 25, is preferably equipped with a tamper indicating device (not shown) for purposes of signaling and/or recording efforts to remove or otherwise access the temperature sensor 40.

10

Compression Sensing System 50

The infant simulator 05 can be equipped with a compression sensing system 50 capable of sensing compression of the doll 10, such as squeezing of the doll's head 11, arms 13 and/or legs 14, and communicating any sensed compression to the central microcontroller unit 20.

15

Referring to Figure 3, a compression sensing system 50 is provided in the head 11 of the doll 10 for sensing squeezing or striking of the head 11. The head 11 is constructed of a pliant material, such as a soft vinyl material, with a normally open electrical circuit 51 provided within the head 11. The first contact 51a of the electrical circuit 51 is a thin layer of conductive material laminated to the inside surface

20

(unnumbered) of the head **11** such that the conductive material moves in concert with the head **11** when the head **11** is deformed. The second contact **51b** of the electrical circuit **51** is a cage of conductive material inwardly spaced from the first contact **51a** of the electrical circuit **51**. The spacing between the first **51a** and second **51b** contacts of the normally open electrical circuit **51** is selected so that the contacts **51a** and **51b** will engage one another and close the electrical circuit **51** when the head **11** is subjected to a compressive force or an impact force reflective of abusive squeezing or striking of the head **11**. Spacing between the first **51a** and second **51b** contacts should be selected so that the compression sensing system **50** will consistently sense compressive and impact forces reflective of abuse without sensing compressive and impact forces reflective of normal handling. The spacing necessary to achieve these desired sensing parameter is dependent upon a number of factors, including the type of material used to construct the head **11**, the thickness of the material forming the head **11**, the size and shape of the head **11**, the flexibility of the material laminated to the inside surface of the head **11** to form the first contact **51a**, etc. By way of illustration, when the head **11** is molded from approximately $\frac{1}{4}$ inch thick plasticized polyvinyl chloride, and the first contact **51a** is a 3 to 4 mil thick aluminum foil, a spacing of approximately $\frac{1}{2}$ to 1 inch should generally provide the desired sensing parameters (*i.e.*, consistently sensing compressive and impact forces reflective of abuse without sensing compressive and impact forces reflective of normal handling).

Optionally, a flexible second cage (not shown) comprising a third contact (not shown) could be positioned intermediate the first **51a** and second **51b** contacts to form a secondary electrical circuit (not shown) with the first contact **51a** in electrical communication with the central microcontroller unit **20**. The third contact (not shown) would be constructed of a material sufficiently flexible to permit the first **51a** and third (not shown) contacts to engage the second contact **51b** when the head **11** experienced an abusive level of compressive or impact force. When such a secondary electrical circuit (not shown) is employed, the compression sensing system **50** is capable of sensing different levels of compressive or impact force (*e.g.*, the secondary circuit is closed when

a "mild" or "low" compressive or impact force is experienced while the primary circuit 51 is closed when an "abusive" or "high" compressive or impact force is experienced).

In a first embodiment, a recording function within the central microcontroller unit 20 records sensed compression episodes for later review by the teacher or program administrator. The specific information recorded and reported by the central microcontroller unit 20 can range from the relatively simple to the complex. For example, the central microcontroller unit 20 can be programmed to simply record and report the occurrence of at least one sensed compression episode during the assignment period. Alternatively, the central microcontroller unit 20 can record and report the number of sensed compression episodes occurring during an assignment period and the duration of each sensed compression episode. A nonexhaustive list of options for recording and reporting compression episode data is set forth in Table Five, provided below.

TABLE FIVE
*(OPTIONS FOR RECORDING AND REPORTING
COMPRESSION EPISODE DATA)*

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records occurrence of first compression episode only.	YES/NO	Light ON/OFF
2	Records number of separate compression episodes.	Number	"3."
3	Records maximum level of compressive force sensed during an assignment period.	Force Level (Low/High)	High

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
5	Records the number of compression episodes sensed during an assignment period and the maximum level of compressive force sensed for each compression episode.	# Force Level (Low/High)	1: Low 2: Low 3: High 4: Low
6	Records the number and duration of each compression episode sensed during an assignment period.	# / Seconds	1: 01 2: 01 3: 08 4: 02

In a second embodiment, the central microcontroller unit **20** is connected to a system (not shown) capable of generating a perceptible distress signal S_3 , such as an audible cry or scream. The central microcontroller unit **20** is programmed to generate the perceptible distress signal S_3 when compression is sensed. Generation of the perceptible distress signal S_3 warns the person caring for the infant simulator **05** that the infant simulator **05** has been subjected to injurious compression or impact. The distress signal S_3 can be terminated, optionally after an appropriate delay, and timing of the compression episode ended, by removing the external event responsible for the compression or impact (e.g., removing the hand of a young sibling squeezing the head **11** of the infant simulator **05**), thereby reopening the compression sensing electrical circuit **51** and terminating transmission of an electrical signal from the electrical circuit **51** to the central microcontroller unit **20**.

15

The central microcontroller unit **20** can be programmed to generate the perceptible distress signal S_3 only at the beginning of a compression episode (i.e.,

generate a three second signal as soon as a compression episode is sensed), continuously throughout a compression episode, or continuously throughout a compression episode and for an additional time period after compression of the infant simulator 05 has ceased for purposes of simulating injury to the infant simulator 05.

5

A preferred embodiment of the compression sensing system 50 combines both the recording and signaling systems.

The distress signal S_3 may be intensified, in accordance with the ancillary feature of providing an escalating demand signal 240, based upon (i) an increase in the maximum sensed compressive force, and/or (ii) an increase in the duration of the compression episode. An example of each is set forth in Table Six, provided below.

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TABLE SIX
(ESCALATING DISTRESS SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	COMPRESSION EPISODE DURATION (SECONDS)	COMPRESSIVE FORCE (°C)
1 st Intensity (cry)	< 5	Low
2 nd Intensity (scream)	> 5	High

EPISODIC EVENTS

Diaper-Change Event

5 The central microcontroller unit **20** can be programmed to effect periodic diaper-change episodes, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, that the diaper **60** on the infant simulator **05** needs to be changed. Preferred soiled-diaper signals S_4 include an audible cry and/or a wetting of the diaper **60**.

10

 The time interval between diaper-change periods can be a bounded random variable (e.g., occurring every 30 to 120 minutes) or a predetermined variable (e.g., sequentially occurring at intervals of 30, 90, 30, 30, 120, 60, 20 and 90 minutes). In order to more accurately emulate the care requirements of an actual infant, and prevent
15 students from memorizing the schedule of events, it is generally preferred to control the time interval between events as a bounded random variable. Alternatively, multiple predefined programs, each providing a different fixed schedule of events, can also be realistically employed so long as the students do not know which program has been selected (i.e., the schedule of events is random from the perspective of the student) and
20 the number of programs is sufficient to prevent the students from memorizing one or two different schedules and thereafter being able to partially defeat the purpose of the program by ignoring the infant simulator **05** between scheduled events.

 Referring to Figure 3, the infant simulator **05** can include a pair of
25 oppositely mounted, normally open Hall Effect switches **62a** and **62b** (hereinafter diaper-change switches), within the torso **12** of the doll **10**. A wide variety of suitable Hall Effect switches **62** are available from a number of different manufacturers, including Hall Effect switch Model No. DN 6851 manufactured by Panasonic. The diaper-change switches **62** are electrically connected to the central microcontroller unit **20**. Because the
30 diaper-change switches **62** are mounted in reverse directions within the doll **10**, the first

diaper-change switch **62a** is closed only by a magnet **61** having a “north” facing polarity, while the second diaper-change switch **62b** is closed only by a magnet **61** having a “south” facing polarity.

5 Referring to Figures 4a and 4b, the student caring for the infant simulator **05** is provided with two diapers **60** sized to fit the infant simulator **05**. A magnet **61** is sewn into each of the diapers **60** at a position effective for placing the magnet **61** in close proximity to the appropriate diaper-change switch **62** when the diaper **60** is fitted onto the doll **10**. The magnet **61** in the first diaper **60a** is rotated so that the magnet **61** has a
10 “north” facing polarity when the first diaper **60a** is fitted onto the doll **10**, while the magnet **61** in the second diaper **60b** is rotated so that the magnet **61** has a “south” facing polarity when the second diaper **60b** is fitted onto the doll **10**. When the appropriate diaper-change switch **62** is closed, an electrical satisfaction signal is sent to the central microcontroller unit **20** and the soiled-diaper signal S_4 is arrested. Timing of the diaper-
15 change episode is also terminated.

The central microcontroller unit **20** initiates a diaper-change episode by alternating the “selected” diaper-change switch **62** as between the first **62a** and second **62b** diaper-change switches, and initiating generation of a perceptible soiled-diaper signal
20 S_4 . In order to arrest the soiled-diaper signal S_4 , the student must close the newly selected diaper-change switch **62** by changing the diaper **60**.

The central microcontroller unit **20** preferably includes a recording function for recording relevant diaper-change episode data for later review by the teacher
25 or program administrator. The specific information recorded by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report the total duration of all diaper-change episodes. Alternatively, the central microcontroller unit **20** can record and report the total number of diaper-change episodes
30 which occurred during an assignment period and the duration of each individual diaper-

change episode. A nonexhaustive list of options for recording and reporting relevant diaper-change episode data is set forth in Table Seven, provided below.

5

TABLE SEVEN
(*OPTIONS FOR RECORDING AND REPORTING*
DIAPER-CHANGE EPISODE DATA)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records and reports total duration of all diaper-change episodes occurring throughout an assignment period.	Minutes	45
2	Records and reports number of diaper-change episodes and total duration of all diaper-change episodes occurring throughout an assignment period.	#/Minutes	5:45
3	Records and reports number of diaper-change episodes, total duration of all diaper-change episodes occurring throughout an assignment period, and mean duration of the diaper-change episodes.	#/Minutes Minutes	5:45 03
3	Records and reports duration of each diaper-change episode occurring throughout an assignment period.	#/Minutes	1: 03 2: 18 3: 20 4: 02 5: 02

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26880

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
4	Records and reports number of diaper-change episodes, total duration of all diaper-change episodes occurring throughout an assignment period, and duration of each diaper-change episode occurring throughout an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

- 5 The central microcontroller unit **20** can be programmed to generate the perceptible soiled-diaper signal S_4 only at the beginning of a diaper-change period (*i.e.*, generate a ten second signal when a diaper-change period is initiated by the central microcontroller unit **20**), periodically throughout a diaper-change period (*e.g.*, generate a two second signal every minute once a diaper-change period is initiated by the central microcontroller unit **20**), or continuously throughout a diaper-change period.

- 10 The soiled-diaper signal S_4 may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon an increase in the duration of the diaper-change episode. An example is set forth in Table Eight, provided below.

TABLE EIGHT
(*ESCALATING SOILED DIAPER SIGNAL*)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	DIAPER-CHANGE EPISODE DURATION (MINUTES)
1 st Intensity (soft cry)	< 10
2 nd Intensity (loud cry)	> 10

5

Rocking Event

The central microcontroller unit **20** can be programmed to effect periodic rocking-request episodes, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, to provide the infant simulator **05** with attentive care in the form of rocking. Preferred types of rocking-request signals S_s include crying, whimpering, fidgeting and combinations thereof.

The time interval between rocking periods can be a bounded random variable (*e.g.*, occurring every 30 to 120 minutes) or a predetermined variable (*e.g.*, sequentially occurring at intervals of 30, 90, 30, 30, 120, 60, 20 and 90 minutes). In order to more accurately emulate the care requirements of an actual infant, and prevent students from memorizing the schedule of events, it is generally preferred to control the time interval between events as a bounded random variable. Alternatively, multiple predefined programs, each providing a different fixed schedule of events, can also be realistically employed so long as the students do not know which program has been selected (*i.e.*, the schedule of events is random from the perspective of the student) and the number of programs is sufficient to prevent the students from memorizing one or two

different schedules and thereafter being able to partially defeat the purpose of the program by ignoring the infant simulator 05 between scheduled events.

Referring to Figure 3, the infant simulator 05 can include a motion sensor 70 within the torso 12 of the doll 10 effective for sensing rocking of the infant simulator 05. A number of different types and styles of motion sensors 70 may be effectively used. One such sensor, capable of providing variable output dependent upon the force of the motion to which the infant simulator 05 is subjected, is a magnetic field induced shock sensor manufactured by Directed Electronics, Inc. under Part No. 5041C wherein movement of a magnet, resulting from a corresponding movement of the doll 10, generates an electrical current in an induction coil, with the strength of the electrical current proportional to the speed and distance traveled by the magnet. The motion sensor 70 is electrically connected to the central microcontroller unit 20 wherein the strength of the electrical current generated by the motion sensor 70 can be checked against predefined threshold limitations for producing different signals dependent upon the strength of the electrical current. This permits the single motion sensor 70 to differentiate between a modest force, such as produced by normal handling, rocking and burping of the infant simulator 05, and excessive force, such as experienced when the infant simulator 05 is thrown, shaken or otherwise abused. When motion of the appropriate amplitude is sensed, an electrical satisfaction signal is sent to the central microcontroller unit 20 and the rocking-request signal S_5 is arrested. Timing of the rocking-request episode is also terminated.

The central microcontroller unit 20 initiates a rocking-request episode by initiating generation of a perceptible rocking-request signal S_5 . In order to arrest the rocking-request signal S_5 , the student must rock the infant simulator 05 with sufficient force to generate an appropriate electrical current in the motion sensor 70 (*i.e.*, sufficient to signal "rocking" but insufficient to signal "abuse").

The central microcontroller unit **20** can be programmed to either terminate or inhibit generation of the rocking-request signal S_s once rocking is sensed. When the termination option is selected, the student need only rock the infant simulator **05** for some minimum time period (*e.g.*, two to ten seconds) sufficient to ensure that rocking has been sensed, after which the student may stop rocking the infant simulator **05** and the rocking-request signal S_s will not begin again. When the inhibition option is selected, the student must continuously rock the infant simulator **05** throughout the rocking period (*e.g.*, five to twenty minutes) to prevent the rocking-request signal S_s from being generated. The inhibition option is generally preferred as it more closely emulates the care requirements of an actual infant.

The central microcontroller unit **20** preferably includes a recording function for recording relevant rocking-request episode data for later review by the teacher or program administrator. The specific information recorded by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report the total duration of all rocking-request episodes. Alternatively, the central microcontroller unit **20** can record and report the total number of rocking-request episodes which occurred during an assignment period and the duration of each individual rocking-request episode. A nonexhaustive list of options for recording and reporting relevant rocking-request episode data is set forth in Table Nine, provided below.

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TABLE TEN

(ESCALATING ROCKING-REQUEST SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	ROCKING-REQUEST EPISODE DURATION (MINUTES)
1 st Intensity (soft cry)	< 10
2 nd Intensity (loud cry)	> 10

5

Feeding Event

The central microcontroller unit **20** can be programmed to effect periodic feeding-request episodes, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, to feed the infant simulator **05**. Preferred types of feeding-request signals S_6 include crying, sucking, outstretched arms **13** and combinations thereof.

The time interval between feeding periods can be a bounded random variable (*e.g.*, occurring every 30 to 120 minutes) or a predetermined variable (*e.g.*, sequentially occurring at intervals of 30, 90, 30, 30, 120, 60, 20 and 90 minutes). In order to more accurately emulate the care requirements of an actual infant, and prevent students from memorizing the schedule of events, it is generally preferred to control the time interval between events as a bounded random variable. Alternatively, multiple predefined programs, each providing a different fixed schedule of events, can also be realistically employed so long as the students do not know which program has been selected (*i.e.*, the schedule of events is random from the perspective of the student) and the number of programs is sufficient to prevent the students from memorizing one or two

different schedules and thereafter being able to partially defeat the purpose of the program by ignoring the infant simulator **05** between scheduled events.

Referring to Figure 3, the infant simulator **05** can include a normally open
5 Hall Effect switch **82** (hereinafter feed switch), within the head **11** of the doll **10** immediately behind the mouth (unnumbered). The feed switch **82** is electrically connected to the central microcontroller unit **20**. The feed switch **82** is normally open, and can be closed only by a magnet **81** having the appropriately directed polarity.

Referring to Figure 5, the student caring for the infant simulator **05** is
10 provided with a bottle **80** scaled to the size of the infant simulator **05**. A magnet **81** is molded into the bottle **80** at a position effective for placing the magnet **81** in close proximity to the feed switch **82** when the bottle **80** is placed against the mouth (unnumbered) of the doll **10**. Alternatively, the magnet **81** can be molded within a key
15 (not shown) bearing indicia representative of a bottle.

The mouth (unnumbered) of the doll **10** can optionally be molded to include a shaped indentation (not shown) into which a correspondingly shaped nipple **80n** on the bottle **80** can be inserted. The shape of the indentation (not shown) and the nipple
20 **80n** are selected so that the bottle **80** must be rotated into a predetermined relationship relative to the head **11** of the doll **10** in order to fit within the indentation (not shown). Such rotation-specific shapes include specifically, but not exclusively, an isosceles triangle, a circular segment, and an "L." When the nipple **80n** of the bottle **80** is fitted within the indentation (not shown) in the mouth (unnumbered) the magnet **81** in the bottle
25 **80** is properly oriented relative to the feed switch **82** and the feed switch **82** is closed. When the feed switch **82** is closed, an electrical satisfaction signal is sent to the central microcontroller unit **20** and the feeding-request signal S_6 arrested. Timing of the feeding-request episode is also terminated.

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OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records and reports total duration of all feeding-request episodes occurring throughout an assignment period.	Minutes	45
2	Records and reports number of feeding-request episodes and total duration of all feeding-request episodes occurring throughout an assignment period.	#/Minutes	5:45
3	Records and reports number of feeding-request episodes, total duration of all feeding-request episodes, and mean duration of the feeding-request episodes occurring throughout an assignment period.	#/Minutes Minutes	5:45 03
3	Records and reports duration of each feeding-request episode occurring throughout an assignment period.	#/Minutes	1: 03 2: 18 3: 20 4: 02 5: 02

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
4	Records and reports number of feeding-request episodes, total duration of all feeding-request episodes, and duration of each feeding-request episode occurring throughout an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

- 5 The central microcontroller unit **20** can be programmed to generate the perceptible feeding-request signal S_6 only at the beginning of a feeding period (*i.e.*, generate a ten second signal when a feeding period is initiated by the central microcontroller unit **20**), periodically throughout a feeding period (*e.g.*, generate a two second signal every minute once a feeding period is initiated by the central microcontroller unit **20**), or continuously throughout a feeding period.
- 10 The feeding-request signal S_6 may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon an increase in the duration of the feeding-request episode. An example is set forth in Table Twelve, provided below.

TABLE TWELVE

(ESCALATING FEEDING-REQUEST SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	FEEDING-REQUEST EPISODE DURATION (MINUTES)
1 st Intensity (soft cry)	< 10
2 nd Intensity (loud cry)	> 10

Burping Event

The central microcontroller unit **20** can be programmed to effect burping-request episodes, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, to burp the infant simulator **05** after the infant simulator **05** has been feed in response to a feeding-request signal S_6 . Burping-request periods can be initiated after the satisfaction of some or all of the feeding periods and is preferably initiated independently of any environmentally sensed conditions (*e.g.*, initiation of a burping period is not contingent upon the student laying the infant simulator **05** face down on the floor after a feeding period). Preferred types of burping-request signals S_7 include crying, whimpering, fidgeting and combinations thereof.

Burping-request periods can be initiated immediately after the end of a satisfied feeding period or after a defined delay (*e.g.*, two to thirty minutes). The delay between the end of a feeding period and initiation of a burping period can be a bounded random variable (*e.g.*, 0 to 30 minutes) or a predetermined variable (*e.g.*, sequentially occurring at intervals of 0, 9, 3, 0, 12, 6, 20 and 9 minutes). In order to more accurately

emulate the care requirements of an actual infant, and prevent students from memorizing and sharing the schedule of events, it is generally preferred to control the length of the delay as a bounded random variable. Alternatively, multiple predefined programs, each providing a different fixed schedule of events including scheduling of burping periods, can also be realistically employed so long as the students do not know which program has been selected (*i.e.*, the schedule of events is random from the perspective of the student) and the number of different delay durations is sufficient to prevent the students from memorizing one or two different delay durations and thereafter being able to partially defeat the purpose of the program by ignoring the infant simulator **05** between sequential feeding and burping events.

Referring to Figure 3, the same motion sensor **70** used for purposes of sensing rocking of the infant simulator **05** can also be effectively used to sense burping of the infant simulator **05** since the type of motion provided by rocking and patting are both detectable by the motion sensor **70**. When motion of the appropriate amplitude is sensed, an electrical satisfaction signal is sent to the central microcontroller unit **20** and the burping-request signal S_7 is arrested. Timing of the burping-request episode is also terminated.

The central microcontroller unit **20** initiates a burping-request episode by initiating generation of a perceptible burping-request signal S_7 . In order to arrest the burping-request signal S_7 , the student must burp or pat the infant simulator **05** with sufficient force to generate an appropriate electrical current in the motion sensor **70** (*i.e.*, sufficient to signal "patting" but insufficient to signal "abuse").

The central microcontroller unit **20** can be programmed to either terminate or inhibit generation of the burping-request signal S_7 once patting is sensed. When the termination option is selected, the student need only burp the infant simulator **05** for some minimum time period (*e.g.*, two to ten seconds) sufficient to ensure that burping has been sensed, after which the student may stop burping the infant simulator **05** and the burping-

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	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967	2968	2969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OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
4	Records and reports number of burping-request episodes, total duration of all burping-request episodes, and duration of each burping-request episode occurring throughout an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

- 5 The central microcontroller unit **20** can be programmed to generate the perceptible burping-request signal S_7 only at the beginning of a burping period (*i.e.*, generate a ten second signal when a burping period is initiated by the central microcontroller unit **20**), periodically throughout a burping period (*e.g.*, generate a two second signal every minute once a burping period is initiated by the central microcontroller unit **20**), or continuously throughout a burping period.

- 10 The burping-request signal S_7 may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon an increase in the duration of the burping-request episode. An example is set forth in Table Fourteen, provided below.

TABLE FOURTEEN

(ESCALATING BURPING-REQUEST SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	BURPING-REQUEST EPISODE DURATION (MINUTES)
1 st Intensity (soft cry)	< 10
2 nd Intensity (loud cry)	> 10

Fussy Event

For purposes of emulating the actions of an actual infant, the central microcontroller unit **20** can be programmed to effect periodic fussy periods, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, to tend to the infant simulator **05**, without an ability to arrest the perceptible signal being generated by the infant simulator **05**. Of course, the implementation of a fussy episode is only meaningful when used in combination with at least one other demand event (*i.e.*, environmental condition and/or episodic event) for which the perceptible signal can be arrested by taking the appropriate action. Fussy events can be interspersed throughout the assignment period as desired for purposes of emulating those times occasionally encountered in real life, when the infant is crying and nothing seems to satisfy the infant.

The central microcontroller unit **20** can be programmed to generate the perceptible fussy signal S_8 only at the beginning of a fussy period (*i.e.*, generate a ten second signal when a fussy period is initiated by the central microcontroller unit **20**), periodically throughout a fussy period (*e.g.*, generate a two second signal every minute

5 The student should be expected to make some effort to satisfy the fussing infant simulator **05**. Handling of the infant simulator **05** can be detected by the same motion sensor **70** used for purposes of sensing rocking and burping of the infant simulator **05**. In the event that no effort is made to satisfy the fussing infant simulator **05**, the fussy signal S_8 may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon a threshold time duration during which the fussy signal S_8 has been generated without any detectable handling. An example is set forth in Table Fifteen, provided below.

15 The perceptible fussy signal S_8 - normal or intensified - is not arrested once handling is detected. The receipt of an electrical “handling” signal by the central microcontroller unit **20** is effective only for preventing escalation of the perceptible fussy signal S_8 . Hence, once the perceptible fussing signal has been intensified, subsequent handling of the infant simulator **05** does not reduce or arrest the perceptible fussy signal S_8 .

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	FUSSY DURATION WITHOUT HANDLING (MINUTES)
1 st Intensity (soft cry)	< 10
2 nd Intensity (loud cry)	> 10

Figure 1 consists of 16 histograms arranged in a 4x4 grid. The columns are labeled 'Nodes' (1, 2, 3, 4) and the rows are labeled 'Time' (1, 2, 3, 4). Each histogram shows the frequency of nodes at a specific time step. The x-axis for each histogram is 'Nodes' (1, 2, 3, 4) and the y-axis is 'Frequency' (0 to 10). The distributions show a shift towards a higher number of nodes over time.

a

fed

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Contented Signal

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can be substantially any perceptible signal recognizable as signaling a happy or contented infant, including specifically, but not exclusively audible signals (*e.g.*, cooing or giggling), olfactory signals (*e.g.*, emission of pleasant scent), visual signals (*e.g.*, smiling, or wiggling of the feet), and multimedia signals (*e.g.*, cooing and smiling).

5

The positive response + can be scheduled to occur immediately upon satisfaction of the requested activity (*e.g.*, after changing a soiled diaper **60** or at the end of a satisfied burping period) or after a defined time delay (*e.g.*, two minutes after changing a soiled diaper **60** or between 20 seconds and two minutes after a satisfied burping period has ended).

10

The microcontroller unit **20** may be programmed to provide the positive response + upon the satisfaction of each and every demand event, only upon the satisfaction of selected demand events, or as a bounded random variable (*e.g.*, only after every other satisfied demand event, only after satisfied burping and diaper-change events, or a 20% chance of occurring after each satisfied demand event). A positive response + should not be provided in connection with an environmentally triggered event (*i.e.*, thermal exposure signal S_2 or distress signal S_3) since satisfaction of such signals is based upon removal of an unpleasant stimuli rather than the comforting satisfaction of a need.

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Escalating Demand Signal 240

The microcontroller unit **20** may be programmed to escalate the strength, intensity and/or severity of the perceptible demand signals generated by the infant simulator **05** as the severity of an environmental condition increases (*e.g.*, the temperature of the infant simulator **05** is more than 5°C greater than a maximum allowable temperature) and/or duration of a demand episode increases (*e.g.*, the demand episode lasts longer than 10 minutes). The escalation can be effected in a variety of ways dependent upon the specific type of signal. For example, an audible cry can be escalated

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module. The ancillary features of multiple time interval durations **260** and multiple period durations **270**, used to create multiple behavior modes, are not shown or depicted in the flowchart as such features are controlled by the central microcontroller unit **20** rather than the individual modules.

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TABLE SIXTEEN
(*LISTING OF MODULES*
AND ANCILLARY FEATURES)

10

MODULE	REFERENCE No.	ANCILLARY FEATURES
INITIATION	100	None
POSITION	110	1. Escalating Demand Signal
TEMPERATURE	120	1. Escalating Demand Signal
COMPRESSION	130	1. Escalating Demand Signal
DIAPER CHANGE	140	1. Contented Signal 2. Identification System 3. Escalating Demand Signal
ROCKING	150	1. Contented Signal 2. Identification System 3. Escalating Demand Signal
FEEDING	160	1. Contented Signal 2. Identification System 3. Escalating Demand Signal

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MODULE	REFERENCE No.	ANCILLARY FEATURES
BURP	170	<ol style="list-style-type: none"> 1. Contented Signal 2. Identification System 3. Escalating Demand Signal
FUSSY	180	None
ASSIGNMENT PERIOD	190	None

The individual modules can occur in any sequence, with the exception of the initiation module **100** which must occur first, the assignment period module **190** which must occur last, and the burping module **170** which can occur only after satisfaction of the feeding module **160**.

Initiation Module 100

Upon activating the infant simulator **05**, the central microcontroller unit **20** turns the bypass signal → ON, begins timing the assignment period, and begins timing the intervals between successive, diaper-change, rocking, feeding, and fussy periods based upon the program selected and/or preprogrammed into the central microcontroller unit **20**. Based upon the program selected, the central microcontroller unit **20** signals each of the diaper-change **140**, rocking **150**, feeding **160** and fussy **180** modules at the appropriate times to start and stop a corresponding demand period, as represented by © in the flow chart. The central microcontroller unit **20** also commences cycling through each of the modules.

Position Module 110

The position sensor 30 detects the position of the infant simulator 05 as between an acceptable position (*e.g.*, laying on its back or left side) and an unacceptable position (*e.g.*, laying face down or upside down) and signals the position module 110 when the infant simulator 05 is detected in an unacceptable position.

Referring to Figure 2b, the position module 110 is bypassed so long as the infant simulator 05 is in an acceptable position. However, when the position module 110 receives a signal from the position sensor 30 that the infant simulator 05 is in an unacceptable position, the position module 110 initiates generation of the repositioning-request signal S_1 by means of the demand signal generating feature 210 embedded within the module 110, starts timing the length of time the repositioning-request signal S_1 is generated, and turns OFF the bypass signal \hookrightarrow .

If the repositioning-request signal S_1 is generated for a predetermined time x (*e.g.*, 10 minutes), the position module 110 increases the intensity of the repositioning-request signal S_1 by means of the escalating demand feature 240 embedded within the position module 110. The repositioning-request signal S_1 is generated at the increased intensity thereafter until the infant simulator 05 is returned to an acceptable position.

Once the infant simulator 05 is returned to an acceptable position, generation of the repositioning-request signal S_1 is turned OFF, the occurrence of a repositioning-request episode is counted, the duration of time during which the infant simulator 05 was in an unacceptable position (*i.e.*, the length of time the repositioning-request signal S_1 was generated) recorded by the recording feature 220, the repositioning-request episode timer is stopped and reset, the intensity of the repositioning-request signal S_1 is checked and returned to normal if intensified, the bypass signal \hookrightarrow is turned back ON, and the position module 110 is exited.

Temperature Module 120

5 The temperature sensor **40** measures the temperature of the infant simulator **05** and signals the temperature module **120** when the temperature falls outside an acceptable temperature range (*i.e.*, less than 15 °C or greater than 35 °C).

Referring to Figure 2c, the temperature module **120** is bypassed so long as the infant simulator **05** is kept at a temperature within the acceptable temperature range.
10 However, when the temperature module **120** receives a signal that the infant simulator **05** is being exposed to an unacceptable temperature, the temperature module **120** initiates generation of the thermal exposure signal S_2 by means of the demand signal generating feature **210** embedded within the temperature module **120**, starts timing the length of time the thermal exposure signal S_2 is generated, and turns OFF the bypass signal \rightarrow .

15 If the thermal exposure signal S_2 is generated for a predetermined time x (*e.g.*, 10 minutes), the temperature module **120** increases the intensity of the thermal exposure signal S_2 by means of the escalating demand feature **240** embedded within the temperature module **120**. The thermal exposure signal S_2 is generated at the increased
20 intensity thereafter until the infant simulator **05** is returned to an acceptable temperature.

Once the infant simulator **05** is returned to an acceptable temperature, generation of the thermal exposure signal S_2 is turned OFF, the occurrence of a thermal exposure episode is counted, the duration of time during which the infant simulator **05**
25 was exposed to unacceptable temperatures (*i.e.*, the length of time the thermal exposure signal S_2 was generated) is recorded by the recording feature **220**, the thermal exposure episode timer is stopped and reset, the intensity of the thermal exposure signal S_2 is checked and returned to normal if intensified, the bypass signal \rightarrow is turned back ON, and the temperature module **120** is exited.

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Compression Module 130

As shown in Figure 3, the compression sensing system **50** detects a
5 compression of the doll's head **11**. When compression is detected by the compression
sensing system **50**, the compression sensing system **50** signals the compression module
130.

Referring to Figure 2d, the compression module **130** is bypassed so long
10 as the head **11** of the infant simulator **05** is not being squeezed or compressed. However,
when the compression module **130** receives a signal that the head **11** of the infant
simulator **05** is being compressed, the compression module **130** initiates generation of the
distress signal S_3 by means of the demand signal generating feature **210** embedded within
the compression module **130**, starts timing the length of time the distress signal S_3 is
15 generated, and turns OFF the bypass signal \rightarrow .

If the duration of the compression, as measured by the length of time the
distress signal S_3 has been generated, exceeds a predetermined time value x (e.g., 10
seconds), the compression module **130** increases the intensity of the distress signal S_3 by
20 means of the escalating demand feature **240** embedded within the compression module
130. The distress signal S_3 is generated at the increased intensity thereafter until some
period of time after compression of the head **11** has ceased.

Once compression of the infant simulator **05** is ceased, the distress signal
25 S_3 continues for some period of time (e.g., 15 minutes) to simulate injury to the infant
simulator **05**. Thereafter, generation of the distress signal S_3 is turned OFF, the occurrence
of a compression episode is counted by the recording feature **220**, the compression timer
is stopped and reset, the intensity of the distress signal S_3 is checked and returned to
normal if intensified, the bypass signal \rightarrow is turned back ON, and the compression module
30 **130** is exited.

Diaper-Change Module 140

5 The central microcontroller unit **20** periodically changes the satisfaction signal St_4 requested by the diaper-change module **140**, such as by alternating between a first satisfaction signal St_4^+ transmitted by a first diaper **60a**, and a second satisfaction signal St_4^- transmitted by a second diaper **60b**.

10 The time intervals between sequential diaper-change episodes is preferably selected so as to emulate the frequency of diaper changes required by an actual infant. By way of example, when the intervals are a predetermined value, the intervals are preferably between about 20 minutes and 6 hours, and when the intervals are bounded random variables, the intervals are preferably between a minimum of 1 to 2 hours and a maximum
15 of 4 to 6 hours, with a statistical preference for a time interval between approximately 2 and approximately 4 hours.

 Referring to Figure 2e, the diaper-change module **140** checks for the currently requested diaper-change satisfaction signal (e.g., St_4^+). The diaper-change
20 module **140** is bypassed so long as the currently requested diaper-change satisfaction signal St_4 is communicated to the diaper-change module **140**.

 In the event that either the currently requested diaper-change satisfaction signal St_4 is no longer received by the diaper-change module **140** (e.g., the first diaper
25 **60a** transmitting the diaper-change satisfaction signal St_4^+ has been removed from the infant simulator **05**), or the central microcontroller unit **20** has changed the requested diaper-change satisfaction signal St_4 (e.g., the requested diaper-change satisfaction signal has been changed from St_4^+ to St_4^-), the diaper-change module **140** initiates generation of a soiled-diaper signal S_4 by means of the demand signal generating feature **210** embedded

within the diaper-change module **140**, and starts timing the duration of the diaper-change episode by timing the length of time the soiled-diaper signal S_4 is generated.

In order to end a diaper-change episode before the time limitation y has been reached, the diaper-change module **140** must receive both an identification signal S^{ID} (e.g., insertion of an identification key **90** attached to the wrist of the assigned care provider by means of a tamper indicating bracelet **91**) and the currently requested satisfaction signal (e.g., transmission of the diaper-change satisfaction signal St_4 by diapering the infant simulator **05** with the second diaper **60b**). For the embodiment depicted in Figure 2e, the identification S^{ID} and diaper-change satisfaction signals St_4 may be received in any sequence and do not need to be transmitted simultaneously.

As shown in Figure 2e, the identification requirement is controlled by the identification system feature **250** embedded within the diaper-change module **140**. The identification system feature **250** prevents exiting of the diaper-change module **140** by bypassing the satisfaction option until the identification signal S^{ID} has been received and the identification switch Sw^{ID} has been turned ON.

If the identification signal S^{ID} and the current diaper-change satisfaction signal St_4 are not received within a given time limit x , as measured by the length of time the soiled-diaper signal S_4 has been generated, the diaper-change module **140** increases the intensity of the soiled-diaper signal S_4 by means of the escalating demand feature **240** embedded within the diaper-change module **140**. The soiled-diaper signal S_4 is generated at the increased intensity for the remainder of the diaper-change episode (i.e., until the identification signal S^{ID} and the current diaper-change satisfaction signal St_4 are received or the time limitation y is reached).

Upon receiving the identification signal S^{ID} and the current diaper-change satisfaction signal St_4 , the soiled-diaper signal S_4 is turned OFF, the occurrence of a diaper-change episode is counted and the length of the diaper-change episode recorded by

At the recording feature 220, the intensity of the distress signal S_3 is checked and returned to normal if intensified, a contented signal + is generated (e.g., a soft “cooing” sound), the identification switch Sw^{ID} is turned back OFF, and the diaper-change module 140 is exited.

5

In the event that the identification signal S^{ID} and the current diaper-change satisfaction signal St_4 are never received during a diaper-change episode (*i.e.*, the soiled-diaper signal S_4 is generated until time limitation y is reached), the soiled-diaper signal S_4 is turned OFF, the occurrence of a diaper-change episode is counted and the length of the diaper-change episode recorded by the recording feature **220**, the timer for timing the duration of the diaper-change episode is stopped and reset, the intensity of the soiled-diaper signal S_4 is checked and returned to normal if intensified, the identification switch Sw^{ID} is turned back OFF, and the diaper-change module **140** is exited. The contented signal + is not generated when the diaper-change module **140** is exited in this manner.

15

The time limitation y is employed for purposes of preventing the soiled-diaper signal S_4 from being generated for the remainder of an assignment period in the event that the identification signal S^{ID} and the current diaper-change satisfaction signal St_4 are never received by the diaper-change module 140. This allows the program to continue cycling through the other modules and interact with a care provider for the balance of the assignment period when an otherwise willing care provider is unable to provide the diaper-change satisfaction signal St_4 , such as could result from a situation in which one of the diapers 60 is misplaced during an assignment period or left at home when traveling.

25

The central microcontroller unit **20** periodically commences a rocking
30 period and communicates the commencement of a rocking period to the rocking module

150. The central microcontroller unit **20** also controls the duration of each rocking period by transmitting a termination signal to the rocking module **150** after the desired time period has lapsed.

5 The time intervals between sequential rocking-request episodes is preferably selected so as to emulate the frequency of requests for attention requested by an actual infant. By way of example, when the intervals are a predetermined value, the intervals are preferably between about 1 to 6 hours, and when the intervals are bounded random variables, the intervals are preferably between a minimum of 1 to 2 hours and a
10 maximum of 4 to 6 hours, with a statistical preference for a time interval between approximately 3 and approximately 5 hours.

 Similarly, the duration of each rocking period is preferably selected so as to emulate the length of time an actual infant would request attention. By way of
15 example, when the duration of a rocking period is a predetermined value, the duration of each rocking period is preferably between about 10 minutes to 1 hour, and when the duration of a rocking period is a bounded random variable, the duration of each rocking period is preferably between a minimum of about 2 minutes and a maximum of about 60,
20 with a statistical preference for a duration between approximately 5 and 20 minutes.

 Referring to Figure 2f, the rocking module **150** is simply bypassed until the central microcontroller unit **20** starts a rocking period. When the central microcontroller unit **20** starts a rocking period, the central microcontroller unit **20** transmits a rocking-request start signal to the rocking module **150**, a rocking-request
25 episode is counted, and the rocking-request episode commenced. The rocking module **150** then initiates generation of the rocking-request signal S_s by means of the demand signal generating feature **210**, and starts timing the duration of the rocking-request episode by timing the length of time the rocking-request signal S_s is generated.

In order to end a rocking-request episode before the entire rocking period has elapsed, the rocking module 150 must receive both an identification signal S^{ID} (e.g., insertion of an identification key 90 attached to the wrist of the assigned care provider by a tamper indicating bracelet 91) and a rocking-request satisfaction signal St_s (e.g., rocking of the infant simulator 05). For the embodiment depicted in Figure 2f, the identification S^{ID} and rocking-request satisfaction St_s signals may be received in any sequence and do not need to be transmitted simultaneously. However, the rocking-request satisfaction signal St_s must be continuously received throughout the rocking period to prevent initiation of a secondary rocking-request episode in which the rocking-request signal S_s is turned back ON and the duration of the supplemental rocking-request episode timed.

As shown in Figure 2f, the identification requirement is controlled by the identification system feature 250 embedded within the rocking module 150. The identification system feature 250 prevents access to the episode termination operations (i.e., turning OFF the rocking-request signal S_s and terminating timing of the rocking-request episode) by bypassing the satisfaction option until the identification signal S^{ID} has been received and the identification switch Sw^{ID} has been turned ON.

If the identification signal S^{ID} and the rocking-request satisfaction signal St_s are not received within a given time limit x , as measured by the length of time the rocking-request signal S_s has been generated, the rocking module 150 increases the intensity of the rocking-request signal S_s by means of the escalating demand feature 240 embedded within the rocking module 150. The rocking-request signal S_s is generated at the increased intensity for the remainder of the rocking-request episode (i.e., until the identification signal S^{ID} and the rocking-request satisfaction signal St_s are received or the end of the rocking period is reached).

Upon receiving the identification S^{ID} and the rocking-request satisfaction St_s signals, the rocking-request signal S_s is turned OFF, the length of the rocking-request

episode recorded by the recording feature 220, the timer for timing the duration of the rocking-request episode stopped and reset, ~~and~~ the intensity of the rocking-request signal S_s checked and returned to normal if intensified.

In contrast to the diaper-change module 140, the rocking module 150 requires that the rocking-request satisfaction signal St_s continue to be transmitted to the rocking module 150 for the entire duration of the rocking period. Failure to continuously provide the rocking-request satisfaction signal St_s throughout the entire rocking period causes the rocking module 150 to reinitiate generation of the rocking-request signal S_s , ~~and~~ start timing the duration of the secondary rocking-request episode.

In order to end a secondary rocking-request episode before the end of the rocking period, the rocking-request satisfaction signal St_s must once again be received by the rocking module 150. It is not necessary to retransmit the identification signal S^{ID} as the identification switch Sw^{ID} remains ON until the rocking period has ended, regardless of the status of the rocking-request satisfaction signal St_s .

When the end of the rocking period is reached, the rocking module 150 performs one of two different sets of operations depending upon the final status of the rocking-request satisfaction signal St_s . In those cases where the rocking-request satisfaction signal St_s was being received by the rocking module 150 at the end of the rocking period, a contented signal + is generated (e.g., a soft "cooing" sound), the identification switch Sw^{ID} is turned back OFF, and the rocking module 150 is exited. In those cases where the rocking-request satisfaction signal St_s was not being received by the rocking module 150 at the end of the rocking period, including those cases where the rocking-request satisfaction signal St_s was never received by the rocking module 150, the rocking-request signal S_s is turned OFF, the length of the rocking-request or supplemental rocking-request episode is recorded by the recording feature 220, the timer for timing the duration of the rocking-request episode is stopped and reset, the intensity of the rocking-request signal S_s is checked and returned to normal if intensified, the identification switch

Sw^{1D} is turned back OFF, and the rocking module 150 is exited. The contented signal + is not generated when the rocking module 150 is exited in the later manner.

5 *Feeding Module 160*

The central microcontroller unit 20 periodically commences a feeding period and communicates the commencement of a feeding period to the feeding module 160. The central microcontroller unit 20 also controls the duration of each feeding period by transmitting a termination signal to the feeding module 160 after the desired time period has lapsed.

The time intervals between sequential feeding-request episodes is preferably selected so as to emulate the frequency of feedings required by an actual infant. By way of example, when the intervals are a predetermined value, the intervals are preferably between about 1 to 6 hours, and when the intervals are bounded random variables, the intervals are preferably between a minimum of 1 to 2 hours and a maximum of 4 to 6 hours, with a statistical preference for a time interval between approximately 3 and approximately 5 hours.

Similarly, the duration of each feeding period is preferably selected so as to emulate the length of time an actual infant would need to be feed. By way of example, when the duration of a feeding period is a predetermined value, the duration of each rocking period is preferably between about 5 to 20 minutes, and when the duration of a rocking period is a bounded random variable, the duration of each rocking period is preferably between a minimum of about 5 minutes and a maximum of about 30, with a statistical preference for a duration between approximately 10 and 20 minutes.

Referring to Figure 2g, the feeding module 160 is simply bypassed until the central microcontroller unit 20 starts a feeding period. When the central

microcontroller unit **20** starts a feeding period, the central microcontroller unit **20** transmits a feeding-request start signal to the feeding module **160**, a feeding-request episode is counted, and the feeding-request episode commenced. The feeding module **160** then initiates generation of the feeding-request signal S_e by means of the demand
5 signal generating feature **210**, starts timing the duration of the feeding-request episode by timing the length of time the feeding-request signal S_e is generated, and turns the burp switch Sw^{BURP} OFF unless the switch is already OFF.

In order to end a feeding-request episode before the entire feeding period
10 has elapsed, the feeding module **160** must receive both an identification signal S^{ID} (e.g., insertion of an identification key **90** attached to the wrist of the assigned care provider by a tamper indicating bracelet **91**) and a feeding-request satisfaction signal St_e (e.g., insertion of a key marked "Feeding"). For the embodiment depicted in Figure 2g, the identification S^{ID} and feeding-request satisfaction St_e signals may be received in any
15 sequence and do not need to be transmitted simultaneously. However, the feeding-request satisfaction signal St_e must be continuously received throughout the feeding period to prevent initiation of a secondary feeding-request episode in which the feeding-request signal S_e is turned back ON, the duration of the supplemental feeding-request episode timed, and the burp switch Sw^{BURP} switched back to OFF.

20 As shown in Figure 2g, the identification requirement is controlled by the identification system feature **250** embedded within the rocking module **150**. The identification system feature **250** prevents access to the episode termination operations (i.e., turning OFF the feeding-request signal S_e and terminating timing of the feeding-request episode) by bypassing the satisfaction option until the identification signal S^{ID} has
25 been received and the identification switch Sw^{ID} has been turned ON.

If the identification signal S^{ID} and the feeding-request satisfaction signal St_e are not received within a given time limit x , as measured by the length of time the
30 feeding-request signal S_e has been generated, the feeding module **160** increases the

the delays are bounded random variables, the delays are preferably between about 0 to 30 minutes, with a statistical preference for delays of between approximately 2 and 10 minutes.

5 Similarly, the duration of each burping period is preferably selected so as to emulate the length of time an actual infant would need to be burped. By way of example, when the duration of a burping period is a predetermined value, the duration of each burping period is preferably between about 2 to 60 minutes, and when the duration of a burping period is a bounded random variable, the duration of each burping period is
10 preferably between about 2 to 60 minutes with a statistical preference for a duration of between approximately 5 and 20 minutes.

Referring to Figure 2h, the burping module 170 is bypassed when the burping switch Sw^{BURP} is OFF (*i.e.*, the infant simulator 05 does not want to be burped
15 when the infant simulator 05 was not properly feed). However, when the burping switch Sw^{BURP} is ON, a burping-request episode is commenced and counted, and the burping switch Sw^{BURP} switched OFF. The burping module 170 then initiates generation of the burping-request signal S_7 by means of the demand signal generating feature 210 embedded within the burping module 170 and starts timing the duration of the burping-
20 request episode by timing the length of time the burping-request signal S_7 is generated.

As with the rocking period and the feeding period, the central microcontroller unit 20 controls the duration of each burping period by transmitting a termination signal to the burping module 170 after the desired time period has lapsed.

25

In order to end a burping-request episode before the entire burping period has elapsed, the burping module 170 must receive both an identification signal S^{ID} (*e.g.*, insertion of an identification key 90 attached to the wrist of the assigned care provider by a tamper indicating bracelet 91) and a burping-request satisfaction signal St_7 (*e.g.*, patting
30 of the infant simulator 05). For the embodiment depicted in Figure 2h, the identification

S^{ID} and burping-request satisfaction **St_r** signals may be received in any sequence and do not need to be transmitted simultaneously. However, the burping-request satisfaction signal **St_r** must be continuously received throughout the burping period to prevent initiation of a secondary burping-request episode in which the burping-request signal **S_r** is turned back ON and the duration of the supplemental burping-request episode timed.

As shown in Figure 2h, the identification requirement is controlled by the identification system feature **250** embedded within the burping module **170**. The identification system feature **250** prevents access to the episode termination operations (i.e., turning OFF the burping-request signal **S_r** and terminating timing of the burping-request episode) by bypassing the satisfaction option until the identification signal **S^{ID}** has been received and the identification switch **Sw^{ID}** has been turned ON.

If the identification signal **S^{ID}** and the burping-request satisfaction signal **St_r** are not received within a given time limit **x**, as measured by the length of time the burping-request signal **S_r** has been generated, the burping module **170** increases the intensity of the burping-request signal **S_r** by means of the escalating demand feature **240** embedded within the burping module **170**. The burping-request signal **S_r** is generated at the increased intensity for the remainder of the burping-request episode (i.e., until the identification signal **S^{ID}** and the burping-request satisfaction signal **St_r** are received or the end of the burping period is reached).

Upon receiving the identification **S^{ID}** and the burping-request satisfaction **St_r** signals, the burping-request signal **S_r** is turned OFF, the length of the burping-request episode recorded by the recording feature **220**, the timer for timing the duration of the burping-request episode stopped and reset, and the intensity of the burping-request signal **S_r** checked and returned to normal if intensified.

As with the rocking module **150** and the feeding module **160** the burping module **170** requires that the burping-request satisfaction signal **St_r** continue to be

transmitted to the burping module 170 for the entire duration of the burping period. Failure to continuously provide the burping-request satisfaction signal St , throughout the entire burping period causes the burping module 170 to reinitiate generation of the burping-request signal S , and start timing the duration of the secondary burping-request episode.

In order to end a secondary burping-request episode before the end of the burping period, the burping-request satisfaction signal St , must once again be received by the burping module 170. It is not necessary to retransmit the identification signal S^{ID} as the identification switch Sw^{ID} remains ON until the burping period has ended, regardless of the status of the burping-request satisfaction signal St .

When the end of the burping period is reached, the burping module 170 performs one of two different sets of operations depending upon the final status of the burping-request satisfaction signal St . In those cases where the burping-request satisfaction signal St , was being received by the burping module 170 at the end of the burping period, a contented signal + is generated (e.g., a soft "cooing" sound), the identification switch Sw^{ID} is turned back OFF, and the burping module 170 is exited. In those cases where the burping-request satisfaction signal St , was not being received by the burping module 170 at the end of the burping period, including those cases where the burping-request satisfaction signal St , was never received by the burping module 170, the burping-request signal S , is turned OFF, the length of the burping-request or supplemental burping-request episode is recorded by the recording feature 220, the timer for timing the duration of the burping-request episode is stopped and reset, the intensity of the burping-request signal S , is checked and returned to normal if intensified, the identification switch Sw^{ID} is turned back OFF, and the burping module 170 is exited. The contented signal + is not generated when the burping module 170 is exited in the later manner.

Fussy Module 180

The central microcontroller unit **20** periodically commences a fussy period and communicates the commencement of a fussy period to the fussy module **180**. The
5 program also controls the duration of each fussy period by transmitting a termination signal to the fussy module **180** after the desired time period has lapsed.

The duration of each fussy period is preferably selected so as to emulate the length of time an actual infant would tend to fuss. By way of example, when the
10 duration of a fussy period is a predetermined value, the duration of fussy period is preferably between about 5 to 20 minutes, and when the duration of a fussy period is a bounded random variable, the duration of each fussy period is preferably between about 2 to 60 minutes with a statistical preference for a duration of about 5 to 20 minutes.

Referring to Figure 2i, the fussy module **180** is simply bypassed until the
15 central microcontroller unit **20** commences a fussy period. When the central microcontroller unit **20** commences a fussy period, the central microcontroller unit **20** transmits a fussy start signal to the fussy module **180**, and a fussy episode is commenced. The fussy module **180** then initiates generation of the fussy signal S_8 by means of the
20 demand signal generating feature **210** embedded within the fussy module **180**.

In contrast to the other episodic modules (*i.e.*, the diaper-change module **140**, the rocking module **150**, the feeding module **160** and the burping module **170**) a
fussy episode cannot be ended until the entire fussy period has run. Hence, the fussy
25 signal S_8 will be generated throughout a fussy period regardless of the actions taken by the care provider. The fussy module **180** emulates those times when, despite every effort by a care provider, an infant cannot be satisfied and continues to fuss. Since the fussy episode cannot be satisfied, the fussy module **180** does not include the recording **220**, contented signal **230**, escalating demand **240** or identification **250** features embedded
30 within the other modules.

When the end of the fussy period is reached, the fussy signal S_8 is turned OFF and the fussy module **180** is exited. A contented signal + is not generated.

5

Assignment Period Module 190

The infant simulator 05 initiates timing of the assignment period upon activation. The duration of the assignment period can either be continuous (*i.e.*, continuing until a teacher or other program administrator takes custody of the infant simulator 05 and stops the assignment period), or predetermined (*i.e.*, a preset duration of 6, 8, 24, 36, 48 or 72 hours selected by the teacher or other program administrator at the beginning of the assignment period).

When the assignment period is a predetermined time period, the central microcontroller unit **20** is preprogrammed with a defined assignment period. The assignment period module **190** compares the length of time the infant simulator **05** has been activated against the duration of the defined assignment period, and causes the program to continue cycling through the various modules until the length of time the infant simulator **05** has been activated equals or exceeds the duration of the defined assignment period. Once the activation period equals or exceeds the assignment period, the program is ended.